

# PATENT ABSTRACTS OF JAPAN

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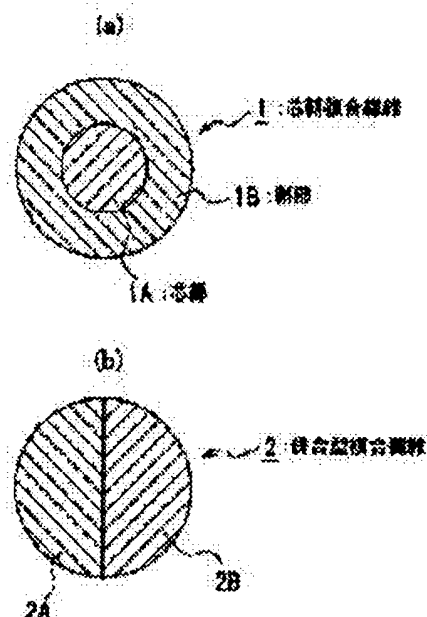
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## (54) LOW RESISTANCE BATTERY SEPARATOR

### (57)Abstract:

**PROBLEM TO BE SOLVED:** To provide a low resistance separator of sufficiently low electric resistance with a low density.

**SOLUTION:** This separator includes glass fibers of an average size of 0.6-4  $\mu\text{m}$  by 5-15 wt.%, core-sheath composite fibers of an average size of 10-20  $\mu\text{m}$  cut in length of 3-7 mm by 25-50 wt.%, and inorganic powder of a specific surface of 150  $\text{g}/\text{m}^2$  or more by 40-55 wt.%, and its density is 0.35-0.45  $\text{g}/\text{cm}^3$ . A fusing point of a sheath part of the core-sheath composite fiber is 70-120°C, and a fusing point of a core part of it is 180°C or more, favorably.



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CLAIMS

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[Claim(s)]

[Claim 1] 5 - 15 % of the weight of glass fibers of 0.6-4 micrometers of diameters of average fiber, 25 - 50 % of the weight of bicomponent fibers of 10-20 micrometers of diameters of average fiber cut into die length of 3-7mm, and specific-surface-area 150 g/m<sup>2</sup> the 40 - 55 % of the weight of the above inorganic fine particles -- containing -- a consistency -- 0.35 - 0.45 g/cm<sup>3</sup> it is -- low resistance battery separator.

[Claim 2] The low resistance battery separator characterized by this bicomponent fiber being a sheath-core bicomponent fiber in claim 1.

[Claim 3] The low resistance battery separator with which the melting point of the sheath of this sheath-core bicomponent fiber is characterized by the melting point of a core part being 180 degrees C or more at 70-120 degrees C in claim 2.

[Claim 4] It is the low resistance battery separator characterized by the sheath of this sheath-core bicomponent fiber consisting of polypropylene in claim 2 or 3.

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DETAILED DESCRIPTION

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## [Detailed Description of the Invention]

[0001]

[Field of the Invention] this invention -- electric resistance -- enough -- low -- low -- it is related with a consistency low resistance battery separator.

[0002]

[Description of the Prior Art] The separator manufactured by the object for automobiles carrying out paper making of the mixture of inorganic powder, such as a glass fiber, a synthetic pulp (the synthetic pulp made from polyethylene is generally used from fields, such as a diameter of fiber.), a synthetic fiber, and a silica, and an organic binder, sheet-izing it by the wet paper making method as a separator used for the liquid type lead accumulator which are the main applications, infiltrating synthetic resin liquid into the desiccation sheet, and subsequently drying conventionally is well-known.

[0003] It is desired in such a separator for electric resistance to be low. That is, if the electric resistance of the separator for batteries for automobiles is made low, engine startability ability of a battery can be made into the outstanding thing.

[0004] However, there is a fault that electric resistance is high, in the thing using the hydrophobic, strong synthetic pulp made from polyethylene. Moreover, also from the diameter of fiber and fiber length distribution being large, detailed fiber covers a front face, and a synthetic pulp bars migration of ion, and raises the electric resistance of a separator.

[0005] Moreover, when the diameter of fiber and the large synthetic pulp of fiber length distribution are used in this way, there is also fault to which the consistency of the separator obtained becomes high.

[0006] Conventionally, as a means which lowers the electric resistance of a separator, the approach (JP,5-54874,A) of making reinforcement holding only with an acrylic resin binder, without using a synthetic pulp, and the approach (JP,7-161344,A) of using a thick glass fiber are proposed.

[0007]

[Problem(s) to be Solved by the Invention] However, for a wrap reason, in the thing using an acrylic resin binder, acrylic resin cannot fully lower electric resistance for a fiber front face.

[0008] Moreover, even if it uses a thick glass fiber, it is difficult not to avoid concomitant use of a synthetic pulp but to reduce electric resistance too.

[0009] the trouble of the above-mentioned former [ this invention ] -- solving -- electric resistance -- enough -- low -- and -- low -- it aims at offering a consistency low resistance battery separator.

[0010]

[Means for Solving the Problem] 25 - 50 % of the weight of bicomponent fibers of 10-20 micrometers of diameters of average fiber with which the low resistance battery separator of this invention was cut into the glass fiber of 5 - 15 % of the weight of 0.6-4 micrometers of diameters of average fiber, and die length of 3-7mm, and specific-surface-area 150 g/m<sup>2</sup> the 40 - 55 % of the weight of the above inorganic fine particles -- containing -- a consistency -- 0.35 - 0.45 g/cm<sup>3</sup> it is -- it is characterized by things.

[0011] According to this invention, configuration holdout and processing reinforcement are securable by using a bicomponent fiber and the sheath-core bicomponent fiber which has the dual structure of a heart-sheath preferably. Moreover, since the bicomponent fiber of the predetermined diameter of fiber is cut and used for predetermined die length, it can prevent that electric resistance is raised by surface coating, and low resistance-ization can be attained. Moreover, low consistency-ization can also be attained.

[0012] As a sheath-core bicomponent fiber, when workability (heat welding nature), a mechanical strength, etc. as a

separator are taken into consideration, it is desirable that the melting point of a sheath is [ the melting point of a core part ] 180 degrees C or more at 70-120 degrees C.

[0013] Moreover, since it excels in chemical resistance and acid resistance, as for the sheath of a sheath-core bicomponent fiber, consisting of polypropylene is desirable.

[0014]

[Embodiment of the Invention] The gestalt of the operation of this invention to the following is explained to a detail.

[0015] The low resistance battery separator of this invention is 5 - 15 % of the weight of glass fibers of 0.6-4 micrometers of diameters of average fiber, 25 - 50 % of the weight of bicomponent fibers of 10-20 micrometers of diameters of average fiber cut into die length of 3-7mm, and the specific surface area of 150g/m<sup>2</sup>. The 40 - 55 % of the weight of the above inorganic fine particles is included.

[0016] As for the diameter of fiber of a glass fiber, it is very effective in the improvement of the solution retention of a separator, and paper-milling nature that it is a narrow diameter. Moreover, by making the consistency of a separator low and making an aperture small, a narrow diameter glass fiber makes the electric resistance of a separator small, and is effective also in improvement in the low-temperature starting characteristic of a battery. Therefore, in this invention, the diameter of fiber of a glass fiber may be 4 micrometers or less. However, the thin glass fiber of the diameter of fiber is too expensive, and since the jump of glass fiber cost is caused, the thing of 0.6 micrometers or more of diameters of average fiber is used. The diameter of average fiber of a desirable glass fiber is 0.6-2 micrometers.

[0017] If dimensional stability worsens that the blending ratio of coal of this glass fiber is less than 5 % of the weight and it exceeds 15 % of the weight, the blending ratio of coal of a sheath-core bicomponent fiber or inorganic fine particles will be made to decrease inevitably, and reinforcement, acid resistance, etc. will fall. Therefore, the blending ratio of coal of a glass fiber may be 5 - 15 % of the weight.

[0018] Moreover, if it is not desirable from the diameter of average fiber of a bicomponent fiber being expensive in a less than 10-micrometer thing and exceeds 20 micrometers, reinforcement and oxidation resistance will fall. If reinforcement falls in less than 3mm and the cut die length of a bicomponent fiber exceeds 7mm, good dispersibility will no longer be acquired.

[0019] Therefore, in this invention, the bicomponent fiber of 10-20 micrometers of diameters of average fiber cut into die length of 3-7mm is used.

[0020] In this invention, as a bicomponent fiber, as are shown in drawing 1 (a), and shown in the sheath-core bicomponent fiber 1 equipped with core part 1A and sheath 1B surrounding the periphery, or drawing 1 (b), the merge mold bicomponent fiber 2 with which partial 2A of different material and 2B were formed in the longitudinal direction can be used.

[0021] The sheath-core bicomponent fiber 1 secures heat welding nature by sheath 1B of comparatively the low melting point, and secures strength in high temperature etc. by high-melting core part 1A comparatively, and it is [ the melting point of the sheath 1B ] desirable that the melting point of 70-120 degrees C and a core part is 180 degrees C or more.

[0022] Moreover, at least, sheath 1B has the desirable thing of the sheath-core bicomponent fiber 1 which consists of the quality of the materials other than hydrophobic large polyethylene, and, as for especially a sheath, becoming from polypropylene is desirable from the point of excelling in chemical resistance or acid resistance.

[0023] as such a sheath-core bicomponent fiber -- a commercial item -- it can use -- for example, following No. -- the thing of 1 and 2 is illustrated.

[0024]

[Table 1]

No.		1	2
商 品 名		ソフィットN-720	メルティ4080
メーカ		クラレ	ユニチカ
芯部	材 質	ポリエステル	ポリエステル
	融点 (°C)	200~260	200~260
鞘部	材 質	変性ポリエステル	変性ポリエステル
	融点 (°C)	110~130	110~130
繊維径 (μm)		13~15	18~22
繊維長 (mm)		5	5~10
芯/鞘比		40/60 又は50/50	70/30

[0025] The merge mold bicomponent fiber 2 also secures heat welding nature by 1 half side 2A of comparatively the low melting point, and secures strength in high temperature etc. by other halves side 2B which is high-melting comparatively, and its melting point by the side of 70-120 degrees C and other halves is [ the melting point of the 1 half side 2B / that it is 180 degrees C or more ] desirable.

[0026] Moreover, as for 1 half side 2B of at least the low melting point of the merge mold bicomponent fiber 2, what consists of the quality of the materials other than hydrophobic large polyethylene is desirable, and, as for especially this 1 half side 2B of the low melting point, becoming from polypropylene is desirable from the point of excelling in chemical resistance or acid resistance.

[0027] As such a merge mold bicomponent fiber 2, a commercial item can be used, for example, denaturation polyester and poly ESURU can be compounded, and the "soffit N-790" (2.5 deniers) by Kuraray cut into 5mm can be used.

[0028] Reinforcement runs short that the blending ratio of coal of such a bicomponent fiber is less than 25 % of the weight, and if it exceeds 50 % of the weight, thermal resistance and hydrophilic properties run short. Therefore, the blending ratio of coal of a bicomponent fiber takes preferably for 30 - 45 % of the weight 25 to 50% of the weight.

[0029] The specific surface area of inorganic fine particles is 150mg/m<sup>2</sup>. Acid resistance becomes being the following inadequate. As such inorganic fine particles, silica powder, diatomaceous earth, etc. can be used and especially silica powder is used suitably.

[0030] If oxidation resistance runs short that the blending ratio of coal of these inorganic fine particles is less than 40 % of the weight and it exceeds 55 % of the weight, the sheet reinforcement at the time of paper making will become inadequate, and manufacture will become difficult. Therefore, the blending ratio of coal of silica powder takes preferably for 45 - 55 % of the weight 40 to 55% of the weight.

[0031] In addition, in this invention, in order to fix such inorganic fine particles to a paper-making sheet at stability at the time of paper making, it is required to carry out minute amount combination of the polymer coagulant, and it is desirable to add a polyacrylamide system polymer at 0.01 - 0.5% of the weight of a rate to inorganic powder as a polymer coagulant.

[0032] The low resistance battery separator of this invention can be easily manufactured by drying at 110-180 degrees C, after mixing the above-mentioned glass fiber, a bicomponent fiber, and inorganic fine particles at a predetermined rate, adding a polymer coagulant further, carrying out wet paper making according to a conventional method and pressing the obtained paper-making sheet.

[0033] Thus, for the low resistance battery separator of this invention manufactured, the consistency is 0.45 g/cm<sup>3</sup>. If large, many ingredients will be needed and will serve as cost quantity. Moreover, consistencies are 0.35 g/cm<sup>3</sup>. An aperture becomes it large that it is the following too much, and acid resistance runs short. Therefore, the consistency of the low resistance battery separator of this invention is 0.35 - 0.45 g/cm<sup>3</sup>. It carries out.

[0034]

[Example] An example and the example of a comparison are given to below, and this invention is more concretely explained to it.

[0035] In addition, the physical properties of the sheath-core bicomponent fiber used in the following examples etc. are as follows. Moreover, as silica powder, the thing of specific surface area of 180m<sup>2</sup> / g was used, using the thing of 0.8

micrometers of diameters of average fiber as a glass fiber.

[0036] The synthetic pulp used in the example of a comparison is a synthetic pulp made from polyethylene with a melting point of 120 degrees C, and polyester fiber does not carry out heat weld at the low temperature of 10-20 micrometers of diameters of fiber.

[0037]

[Table 2]

No.		A	B
芯部	材質	ポリエステル	ポリエステル
	融点 (℃)	200	200
鞘部	材質	変性ポリエステル	変性ポリエステル
	融点 (℃)	70	110
繊維径 (μm)		10~20	10~20
繊維長 (mm)		5~7	5~7
芯/鞘比		50/50	70/30

[0038] Moreover, the measuring methods, such as the property of the obtained separator, are as follows.

[0039] \*\* Start an eyes sample to 20cmx25cm, and measure weight. The value is doubled 20 and it displays as eyes. A unit is g/m2. It expresses.

\*\* It is based on thickness JIS2313. 20 Kg/cm2 It measures in the dial gage or the equivalent fixture which requires pressurization. A unit is expressed with mm.

\*\* Calculate by consistency eyes / thickness /1000. A unit is g/cm3. It expresses.

\*\* It is based on tensile strength JIS 2313. A 10mmx70mm test piece is cut down, and it applies to a tester, and pulls [ grip spacing is pulled by about 50mm, and ] by part for hauling speed 200mm/, and the reinforcement at the time of fracture is measured (kg). Tensile strength is calculated by breaking this reinforcement by the width of face (10mm) of a test piece, and thickness of a sample. A unit is Kg/mm2. It expresses.

[0040] \*\* It is based on electric resistance JIS 2313. The test piece of about 7cm angle is immersed into convention number-of-sheets logging and the dilute sulfuric acid of specific gravity 1.2, and a current is passed and measured after setting in a measuring device. A unit is expressed with omega-dm 2 / \*\*. The test piece of 7cm angle of <BR> \*\* anti-oxidation time amount is set to inter-electrode [ of 5cm angle ], a 5kg load is applied, and it expresses with the time amount from which the sink and the electrical potential difference became less than [ 1.2V ] about the impregnation aftercurrent in the dilute sulfuric acid of specific gravity 1.3. A unit is expressed with time amount (Hr). In addition, this anti-oxidation time amount may be considered to be the life of a separator, and this is also the life of the cell itself as it is. Namely, the engine performance is so high that anti-oxidation time amount is long as a battery separator.

[0041] The raw material was mixed by the combination shown in examples 1 and 2 and example of comparison 1 table 3, underwater, it distributed and the polyacrylamide system polymer was further added 0.1% of the weight to silica powder, disaggregation and after carrying out paper making and pressing with a wet paper machine, it dried at 130 degrees C underwater, and the separator was obtained. Many properties of this separator were measured and the result was shown in Table 3.

[0042] It mixed by the combination which shows the acrylic ester emulsion and silica powder example of comparison 2 glass fiber, a polyethylene synthetic pulp, polyester fiber, and whose Tg are 15 degrees C in Table 3, and disaggregated and distributed underwater. this raw material liquid -- a sulfuric-acid band -- silica powder -- receiving -- 3 % of the weight and a macromolecule polymer -- 0.1 % of the weight -- adding -- an example 1 -- the same -- carrying out -- paper making -- it pressed and dried, the separator was obtained and the measurement result of many of those properties was shown in Table 3.

[0043] Table 3 shows that the low resistance battery separator of this invention excels [ electric resistance ] in acid resistance by the low consistency low moreover remarkably.

[0044]

[Table 3]

例		実 施 例		比 較 例	
		1	2	1	2
材 料 配 合 … 重 量 %	ガラス繊維	10	10	5	5
	芯鞘複合繊維A	40			
	芯鞘複合繊維B		40		
	シリカ粉末	50	50	50	50
	合成バルブ			35	15
	ポリエステル繊維			10	10
	アクリル酸エステル イタリオン(固形分)				20
評 価 項 目	目 付 (g/m <sup>2</sup> )	118	120	133	135
	厚 み (mm)	0.30	0.31	0.31	0.30
	密 度 (g/cm <sup>3</sup> )	0.39	0.40	0.43	0.45
	抗 張 力 (Kg/mm <sup>2</sup> )	0.30	0.35	0.35	0.40
	電気抵抗 (Ω d m <sup>2</sup> /枚)	0.0003	0.0003	0.0006	0.0005
	耐酸化時間 (Hr)	>96	>96	80	90

[0045]

[Effect of the Invention] according to [ as explained in full detail above ] the low resistance battery separator of this invention -- electric resistance -- low -- acid resistance -- excelling -- moreover -- low -- the consistency separator for batteries is offered.

[Translation done.]



JAPANESE

[JP,11-250889,A]

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CLAIMS DETAILED DESCRIPTION TECHNICAL FIELD PRIOR ART EFFECT OF THE INVENTION  
TECHNICAL PROBLEM MEANS EXAMPLE DESCRIPTION OF DRAWINGS DRAWINGS

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TECHNICAL FIELD

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PRIOR ART

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[Description of the Prior Art] The separator manufactured by the object for automobiles carrying out paper making of the mixture of inorganic powder, such as a glass fiber, a synthetic pulp (the synthetic pulp made from polyethylene be generally used from Men, such as a diameter of fiber.), a synthetic fiber, and a silica, and an organic binder, sheet-izing it by the wet paper making method as a separator used for the liquid type lead accumulator which be the main applications, infiltrating synthetic resin liquid into the desiccation sheet, and subsequently drying conventionally be well-known.

[0003] It is desired in such a separator for electric resistance to be low. That is, if the electric resistance of the separator for batteries for automobiles is made low, engine startability ability of a battery can be made into the outstanding thing.

[0004] However, there is a fault that electric resistance is high, in the thing using the hydrophobic, strong synthetic pulp made from polyethylene. Moreover, also from the diameter of fiber and fiber length distribution being large, detailed fiber covers a front face, and a synthetic pulp bars migration of ion, and raises the electric resistance of a separator.

[0005] Moreover, when the diameter of fiber and the large synthetic pulp of fiber length distribution are used in this way, there is also fault to which the consistency of the separator obtained becomes high.

[0006] Conventionally, as a means which lowers the electric resistance of a separator, the approach (JP,5-54874,A) of making reinforcement holding only with an acrylic resin binder, without using a synthetic pulp, and the approach (JP,7-161344,A) of using a thick glass fiber are proposed.

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EFFECT OF THE INVENTION

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TECHNICAL PROBLEM

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[Problem(s) to be Solved by the Invention] However, for a wrap reason, in the thing using an acrylic resin binder, acrylic resin cannot fully lower electric resistance for a fiber front face.

[0008] Moreover, even if it uses a thick glass fiber, it is difficult not to avoid concomitant use of a synthetic pulp but to reduce electric resistance too.

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## MEANS

[Means for Solving the Problem] 25 - 50 % of the weight of bicomponent fibers of 10-20 micrometers of diameters of average fiber with which the low resistance battery separator of this invention was cut into the glass fiber of 5 - 15 % of the weight of 0.6-4 micrometers of diameters of average fiber, and die length of 3-7mm, and specific-surface-area 150 g/m<sup>2</sup> the 40 - 55 % of the weight of the above inorganic fine particles -- containing -- a consistency -- 0.35 - 0.45 g/cm<sup>3</sup> it is -- it is characterized by things.

[0011] According to this invention, configuration holdout and processing reinforcement are securable by using a bicomponent fiber and the sheath-core bicomponent fiber which has the dual structure of a heart-sheath preferably. Moreover, since the bicomponent fiber of the predetermined diameter of fiber is cut and used for predetermined die length, it can prevent that electric resistance is raised by surface coating, and low resistance-ization can be attained. Moreover, low consistency-ization can also be attained.

[0012] As a sheath-core bicomponent fiber, when workability (heat welding nature), a mechanical strength, etc. as a separator are taken into consideration, it is desirable that the melting point of a sheath is [ the melting point of a core part ] 180 degrees C or more at 70-120 degrees C.

[0013] Moreover, since it excels in chemical resistance and acid resistance, as for the sheath of a sheath-core bicomponent fiber, consisting of polypropylene is desirable.

[0014]

[Embodiment of the Invention] The gestalt of the operation of this invention to the following is explained to a detail.

[0015] The low resistance battery separator of this invention is [ 5 - 15 % of the weight of glass fibers of 0.6-4 micrometers of diameters of average fiber, 25 - 50 % of the weight of bicomponent fibers of 10-20 micrometers of diameters of average fiber cut into die length of 3-7mm, and ] specific-surface-area 150 g/m<sup>2</sup>. The 40 - 55 % of the weight of the above inorganic fine particles is included.

[0016] As for the diameter of fiber of a glass fiber, it is very effective in the improvement of the solution retention of a separator, and paper-milling nature that it is a narrow diameter. Moreover, by making the consistency of a separator low and making an aperture small, a narrow diameter glass fiber makes the electric resistance of a separator small, and is effective also in improvement in the low-temperature starting characteristic of a battery. Therefore, in this invention, the diameter of fiber of a glass fiber may be 4 micrometers or less. However, the thin glass fiber of the diameter of fiber is too expensive, and since the jump of glass fiber cost is caused, the thing of 0.6 micrometers or more of diameters of average fiber is used. The diameter of average fiber of a desirable glass fiber is 0.6-2 micrometers.

[0017] If dimensional stability worsens that the blending ratio of coal of this glass fiber is less than 5 % of the weight and it exceeds 15 % of the weight, the blending ratio of coal of a sheath-core bicomponent fiber or inorganic fine particles will be made to decrease inevitably, and reinforcement, acid resistance, etc. will fall. Therefore, the blending ratio of coal of a glass fiber may be 5 - 15 % of the weight.

[0018] Moreover, if it is not desirable from the diameter of average fiber of a bicomponent fiber being expensive in a less than 10-micrometer thing and exceeds 20 micrometers, reinforcement and oxidation resistance will fall. If reinforcement falls in less than 3mm and the cut die length of a bicomponent fiber exceeds 7mm, good dispersibility will no longer be acquired.

[0019] Therefore, in this invention, the bicomponent fiber of 10-20 micrometers of diameters of average fiber cut into die length of 3-7mm is used.

[0020] In this invention, as a bicomponent fiber, as are shown in drawing 1 (a), and shown in the sheath-core bicomponent fiber 1 equipped with core part 1A and sheath 1B surrounding the periphery, or drawing 1 (b), the merge mold bicomponent fiber 2 with which partial 2A of different material and 2B were formed in the longitudinal direction can be used.

[0021] The sheath-core bicomponent fiber 1 secures heat welding nature by sheath 1B of comparatively the low melting point, and secures strength in high temperature etc. by high-melting core part 1A comparatively, and it is [ the melting point of the sheath 1B ] desirable that the melting point of 70-120 degrees C and a core part is 180 degrees C or more.

[0022] Moreover, at least, sheath 1B has the desirable thing of the sheath-core bicomponent fiber 1 which consists of the quality of the materials other than hydrophobic large polyethylene, and, as for especially a sheath, becoming from polypropylene is desirable from the point of excelling in chemical resistance or acid resistance.

[0023] as such a sheath-core bicomponent fiber -- a commercial item -- it can use -- for example, following No. -- the thing of 1 and 2 is illustrated.

[0024]

[Table 1]

No.		1	2
商 品 名		ソフィットN-720	メルティ4080
メ ー カ ー		クラレ	ユニチカ
芯 部	材 質	ポリエステル	ポリエステル
	融点 (°C)	200~260	200~260
鞘 部	材 質	変性ポリエステル	変性ポリエステル
	融点 (°C)	110~130	110~130
繊維径 (μm)		13~15	18~22
繊維長 (mm)		5	5~10
芯/鞘比		40/60 又は50/50	70/30

[0025] The merge mold bicomponent fiber 2 also secures heat welding nature by 1 half side 2A of comparatively the low melting point, and secures strength in high temperature etc. by other halves side 2B which is high-melting comparatively, and its melting point by the side of 70-120 degrees C and other halves is [ the melting point of the 1 half side 2B / that it is 180 degrees C or more ] desirable.

[0026] Moreover, as for 1 half side 2B of at least the low melting point of the merge mold bicomponent fiber 2, what consists of the quality of the materials other than hydrophobic large polyethylene is desirable, and, as for especially this 1 half side 2B of the low melting point, becoming from polypropylene is desirable from the point of excelling in chemical resistance or acid resistance.

[0027] As such a merge mold bicomponent fiber 2, a commercial item can be used, for example, denaturation polyester and poly ESURU can be compounded, and the "soffit N-790" (2.5 deniers) by Kuraray cut into 5mm can be used.

[0028] Reinforcement runs short that the blending ratio of coal of such a bicomponent fiber is less than 25 % of the weight, and if it exceeds 50 % of the weight, thermal resistance and hydrophilic properties run short. Therefore, the blending ratio of coal of a bicomponent fiber takes preferably for 30 - 45 % of the weight 25 to 50% of the weight.

[0029] The specific surface area of inorganic fine particles is 150 mg/m<sup>2</sup>. Acid resistance becomes being the following inadequate. As such inorganic fine particles, silica powder, diatomaceous earth, etc. can be used and especially silica powder is used suitably.

[0030] If oxidation resistance runs short that the blending ratio of coal of these inorganic fine particles is less than 40 % of the weight and it exceeds 55 % of the weight, the sheet reinforcement at the time of paper making will become inadequate, and manufacture will become difficult. Therefore, the blending ratio of coal of silica powder takes preferably for 45 - 55 % of the weight 40 to 55% of the weight.

[0031] In addition, in this invention, in order to fix such inorganic fine particles to a paper-making sheet at stability at the time of paper making, it is required to carry out minute amount combination of the polymer coagulant, and it is desirable to add a polyacrylamide system polymer at 0.01 - 0.5% of the weight of a rate to inorganic powder as a polymer coagulant.

[0032] The low resistance battery separator of this invention can be easily manufactured by drying at 110-180 degrees C, after mixing the above-mentioned glass fiber, a bicomponent fiber, and inorganic fine particles at a predetermined

rate, adding a polymer coagulant further, carrying out wet paper making according to a conventional method and pressing the obtained paper-making sheet.

[0033] Thus, for the low resistance battery separator of this invention manufactured, the consistency is 0.45 g/cm<sup>3</sup>. If large, many ingredients will be needed and will serve as cost quantity. Moreover, consistencies are 0.35 g/cm<sup>3</sup>. An aperture becomes it large that it is the following too much, and acid resistance runs short. Therefore, the consistency of the low resistance battery separator of this invention is 0.35 - 0.45 g/cm<sup>3</sup>. It carries out.

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[Translation done.]



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## EXAMPLE

[Example] An example and the example of a comparison are given to below, and this invention is more concretely explained to it.

[0035] In addition, the physical properties of the sheath-core bicomponent fiber used in the following examples etc. are as follows. Moreover, as silica powder, the thing of specific surface area of 180m<sup>2</sup>/g was used, using the thing of 0.8 micrometers of diameters of average fiber as a glass fiber.

[0036] The synthetic pulp used in the example of a comparison is a synthetic pulp made from polyethylene with a melting point of 120 degrees C, and polyester fiber does not carry out heat weld at the low temperature of 10-20 micrometers of diameters of fiber.

[0037]

[Table 2]

No.		A	B
芯部	材質	ポリエステル	ポリエステル
	融点 (°C)	200	200
鞘部	材質	変性ポリエステル	変性ポリエステル
	融点 (°C)	70	110
繊維径 (μm)		10~20	10~20
繊維長 (mm)		5~7	5~7
芯/鞘比		50/50	70/30

[0038] Moreover, the measuring methods, such as the property of the obtained separator, are as follows.

[0039] \*\* Start an eyes sample to 20cmx25cm, and measure weight. The value is doubled 20 and it displays as eyes. A unit is g/m<sup>2</sup>. It expresses.

\*\* It is based on thickness JIS2313. 20 Kg/cm<sup>2</sup> It measures in the dial gage or the equivalent fixture which requires pressurization. A unit is expressed with mm.

\*\* Calculate by consistency eyes / thickness / 1000. A unit is g/cm<sup>3</sup>. It expresses.

\*\* It is based on tensile strength JIS 2313. A 10mmx70mm test piece is cut down, and it applies to a tester, and pulls [ grip spacing is pulled by about 50mm, and ] by part for hauling speed 200mm/, and the reinforcement at the time of fracture is measured (kg). Tensile strength is calculated by breaking this reinforcement by the width of face (10mm) of a test piece, and thickness of a sample. A unit is Kg/mm<sup>2</sup>. It expresses.

[0040] \*\* It is based on electric resistance JIS 2313. The test piece of about 7cm angle is immersed into convention number-of-sheets logging and the dilute sulfuric acid of specific gravity 1.2, and a current is passed and measured after setting in a measuring device. A unit is expressed with omega-dm<sup>2</sup> / \*\*.

\*\* Set the test piece of 7cm angle of anti-oxidation time amount to inter-electrode [ of 5cm angle ], apply a 5kg load, and express with the time amount from which the sink and the electrical potential difference became less than [ 1.2V ] about the impregnation aftercurrent in the dilute sulfuric acid of specific gravity 1.3. A unit is expressed with time amount (Hr). In addition, this anti-oxidation time amount may be considered to be the life of a separator, and this is also the life of the cell itself as it is. Namely, the engine performance is so high that anti-oxidation time amount is long as a battery separator.

[0041] The raw material was mixed by the combination shown in examples 1 and 2 and example of comparison 1 table 3, underwater, it distributed and the polyacrylamide system polymer was further added 0.1% of the weight to silica powder, disaggregation and after carrying out paper making and pressing with a wet paper machine, it dried at 130 degrees C underwater, and the separator was obtained. Many properties of this separator were measured and the result was shown in Table 3.

[0042] It mixed by the combination which shows the acrylic ester emulsion and silica powder example of comparison 2 glass fiber, a polyethylene synthetic pulp, polyester fiber, and whose Tg are 15 degrees C in Table 3, and disaggregated and distributed underwater. this raw material liquid -- a sulfuric-acid band -- silica powder -- receiving -- 3 % of the weight and a macromolecule polymer -- 0.1 % of the weight -- adding -- an example 1 -- the same -- carrying out -- paper making -- it pressed and dried, the separator was obtained and the measurement result of many of those properties was shown in Table 3.

[0043] Table 3 shows that the low resistance battery separator of this invention excels [ electric resistance ] in acid resistance by the low consistency low moreover remarkably.

[0044]

[Table 3]

例		実 施 例		比 較 例	
		1	2	1	2
材 料 配 合 … 重 量 %	ガラス繊維	10	10	5	5
	芯鞘複合繊維A	40			
	芯鞘複合繊維B		40		
	シリカ粉末	50	50	50	50
	合成パルプ			35	15
	ポリエステル繊維			10	10
	アクリル酸エステル エマルジョン(固形分)				20
評 価 項 目	目 付 (g/m <sup>2</sup> )	118	120	133	135
	厚 み (mm)	0.30	0.31	0.31	0.30
	密 度 (g/cm <sup>3</sup> )	0.39	0.40	0.43	0.45
	抗 張 力 (Kg/mm <sup>2</sup> )	0.30	0.35	0.35	0.40
	電気抵抗 (Ω・dm <sup>2</sup> /枚)	0.0003	0.0003	0.0006	0.0005
	耐酸化時間 (Hr)	>96	>96	80	90

[Translation done.]

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DESCRIPTION OF DRAWINGS

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[Brief Description of the Drawings]

[Drawing 1] It is the sectional view showing the gestalt of operation of the bicomponent fiber used by this invention.

[Description of Notations]

1 Sheath-core Bicomponent Fiber

1A Core part

1B Sheath

2 Merge Mold Bicomponent Fiber

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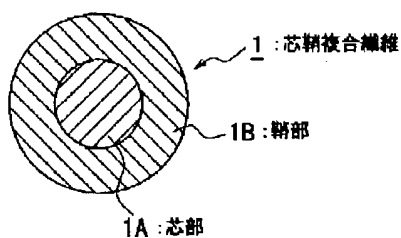
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DRAWINGS

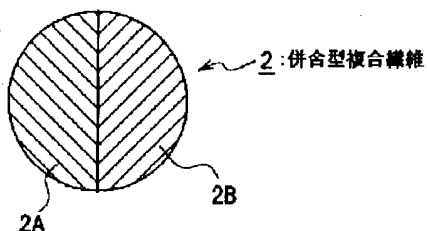
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[Drawing 1]

(a)



(b)



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[Translation done.]